

# FCC PART 15.247 TEST REPORT

For

## CLC HONG KONG LIMITED

1011A, 10/F., Harbour Centre Tower 1, No.1 Hok Cheung St., Hung Hom, Kowloon, Hong Kong

**FCC ID: 2AG4WZ811**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Optimax 11
<b>Report Number:</b> RDG180326005-00C	
<b>Report Date:</b> 2018-04-08	
Jerry Zhang EMC Manager	
<b>Reviewed By:</b> <i>Jerry Zhang</i>	
<b>Test Laboratory:</b> Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 <a href="http://www.baclcorp.com.cn">www.baclcorp.com.cn</a>	

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).  
This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA\* or any agency of the Federal Government. \* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “\*”

## **TABLE OF CONTENTS**

<b>GENERAL INFORMATION.....</b>	<b>4</b>
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT) .....	4
OBJECTIVE .....	4
RELATED SUBMITTAL(S)/GRANT(S).....	4
TEST METHODOLOGY .....	4
MEASUREMENT UNCERTAINTY .....	5
TEST FACILITY .....	5
<b>SYSTEM TEST CONFIGURATION.....</b>	<b>6</b>
DESCRIPTION OF TEST CONFIGURATION .....	6
EUT EXERCISE SOFTWARE .....	6
EQUIPMENT MODIFICATIONS .....	8
SUPPORT CABLE LIST AND DETAILS .....	8
BLOCK DIAGRAM OF TEST SETUP .....	9
<b>SUMMARY OF TEST RESULTS .....</b>	<b>10</b>
<b>FCC §15.247 (i) &amp; §1.1310 &amp; §2.1093- RF EXPOSURE.....</b>	<b>11</b>
APPLICABLE STANDARD .....	11
<b>FCC §15.203 - ANTENNA REQUIREMENT.....</b>	<b>12</b>
APPLICABLE STANDARD .....	12
ANTENNA CONNECTOR CONSTRUCTION .....	12
<b>FCC §15.207 (a)– AC LINE CONDUCTED EMISSIONS .....</b>	<b>13</b>
APPLICABLE STANDARD .....	13
EUT SETUP .....	13
EMI TEST RECEIVER SETUP.....	13
TEST PROCEDURE .....	14
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	14
TEST EQUIPMENT LIST AND DETAILS.....	14
TEST DATA .....	15
<b>FCC §15.209, §15.205 &amp; §15.247(d) - SPURIOUS EMISSIONS.....</b>	<b>17</b>
APPLICABLE STANDARD .....	17
EUT SETUP .....	17
EMI TEST RECEIVER & SPECTRUM ANALYZER SETUP .....	18
TEST PROCEDURE .....	18
CORRECTED AMPLITUDE & MARGIN CALCULATION .....	18
TEST EQUIPMENT LIST AND DETAILS.....	19
TEST DATA .....	19
<b>FCC §15.247(a) (2)–6 dB EMISSION BANDWIDTH.....</b>	<b>27</b>
APPLICABLE STANDARD .....	27
TEST PROCEDURE .....	27
TEST EQUIPMENT LIST AND DETAILS.....	27
TEST DATA .....	27
<b>FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER.....</b>	<b>33</b>
APPLICABLE STANDARD .....	33
TEST PROCEDURE .....	33
TEST EQUIPMENT LIST AND DETAILS.....	33
TEST DATA .....	34

<b>FCC §15.247(d)– 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE.....</b>	<b>35</b>
APPLICABLE STANDARD .....	35
TEST PROCEDURE .....	35
TEST EQUIPMENT LIST AND DETAILS.....	35
TEST DATA .....	36
<b>FCC §15.247(e) - POWER SPECTRAL DENSITY .....</b>	<b>40</b>
APPLICABLE STANDARD .....	40
TEST PROCEDURE .....	40
TEST EQUIPMENT LIST AND DETAILS.....	40
TEST DATA .....	40

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

<b>EUT Name:</b>		Optimax 11
<b>EUT Model:</b>		Z811
<b>FCC ID:</b>		2AG4WZ811
<b>Rated Input Voltage:</b>		DC3.7V from battery or DC 5V from adapter
<b>Adapter Information</b>	<b>Model:</b>	PMC44
	<b>Input:</b>	100-240V~ 50/60Hz 0.2A
	<b>Output:</b>	5V , 1.5A
<b>External Dimension:</b>		Length (207.2 mm)*Width (124 mm)*High (10.3 mm)
<b>Serial Number:</b>		180326005
<b>EUT Received Date:</b>		2018.03.26

### Objective

This report is prepared on behalf of **CLC HONG KONG LIMITED** in accordance with Part 2, Subpart J, Part 15, Subparts A and C of the Federal Communications Commission's rules.

The tests were performed in order to determine the compliance of the EUT with FCC Rules Part 15-Subpart C, section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: 2AG4WZ811.

FCC Part 15B JBP submissions with FCC ID: 2AG4WZ811.

FCC Part 22H, 24E PCE submissions with FCC ID: 2AG4WZ811.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and KDB 558074 D01 DTS Meas Guidance v04.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

**Measurement Uncertainty**

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.61dB
Power Spectral Density, conducted	±0.61 dB
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB
Unwanted Emissions, conducted	±1.5 dB
Temperature	±1 °C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

**Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218,the FCC Designation No. : CN1220.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062D.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

For 2.4GHz band, total 11 channels are provided:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437	/	/

For 802.11b, 802.11g, and 802.11n ht20 modes were test with channel 1,6,11.

The worst-case data rates are determined to be as follows for each mode based upon investigations by measuring the average power and PSD across all data rates bandwidths, and modulations.

### EUT Exercise Software

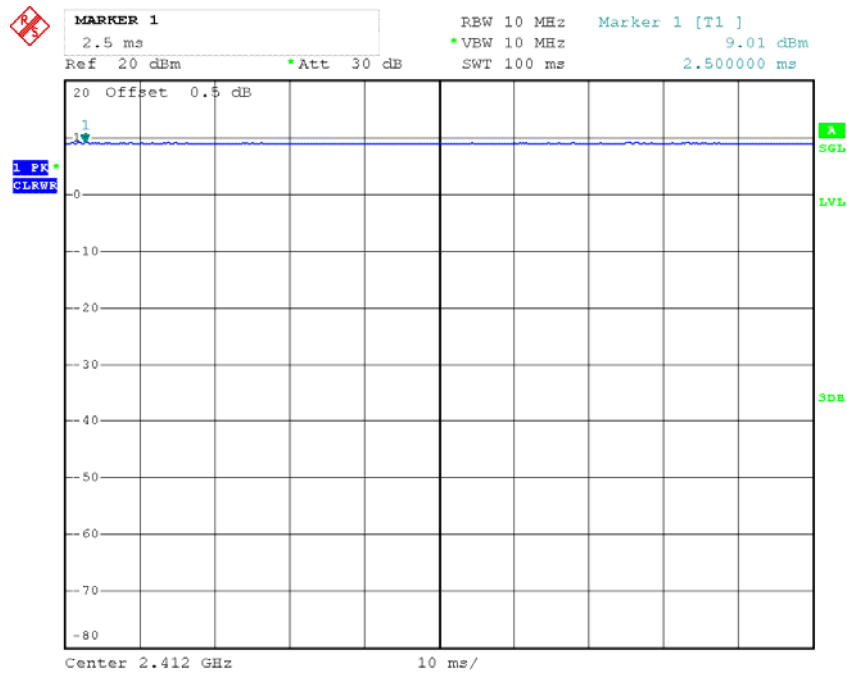
The software “Engineer Mode” was used for testing, which was provided by manufacturer. The maximum power was configured as below table, that provided by the manufacturer:

Test Mode	Test Software Version	Engineering Mode		
802.11b	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	1Mbps	1Mbps	1Mbps
	Power Level Setting	50	47	46
802.11g	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6Mbps	6Mbps	6Mbps
	Power Level Setting	50	47	46
802.11n ht20	Test Frequency	2412MHz	2437MHz	2462MHz
	Data Rate	6.5Mbps	6.5Mbps	6.5Mbps
	Power Level Setting	105	101	100

The maximum duty cycle as following table:

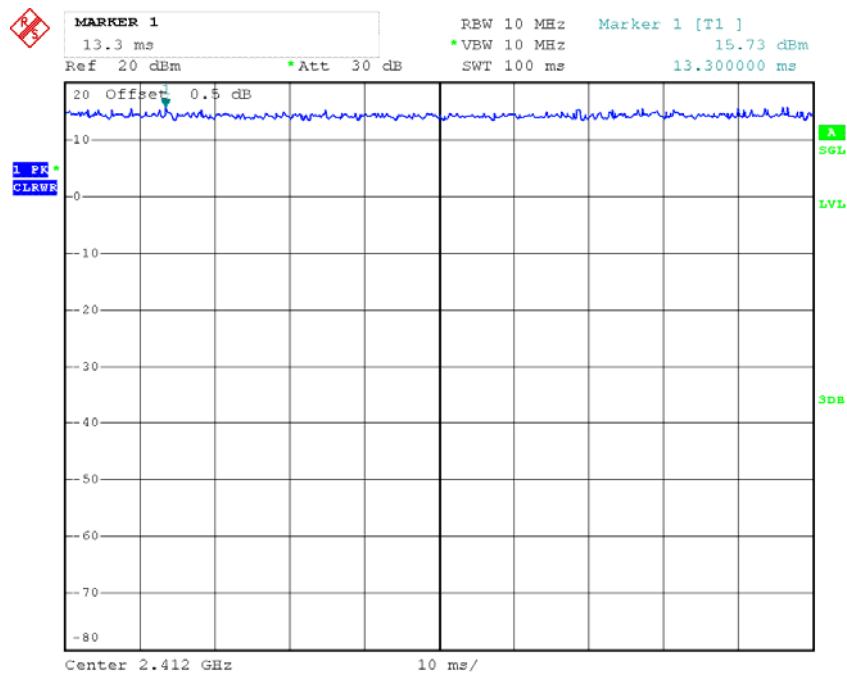
Test mode	T <sub>on</sub> (ms)	T <sub>on+off</sub> (ms)	Duty Cycle (%)
802.11b	100	100	100
802.11g	100	100	100
802.11n ht20	100	100	100

### 802.11b



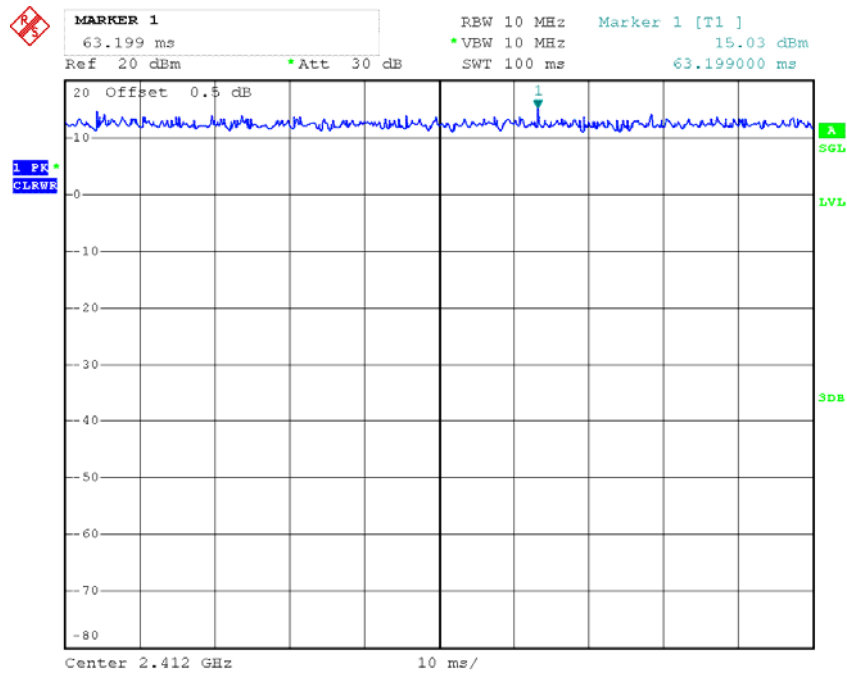
Date: 2.APR.2018 12:42:06

### 802.11g



Date: 2.APR.2018 12:42:55

## 802.11n ht20



Date: 2.APR.2018 14:07:11

## Equipment Modifications

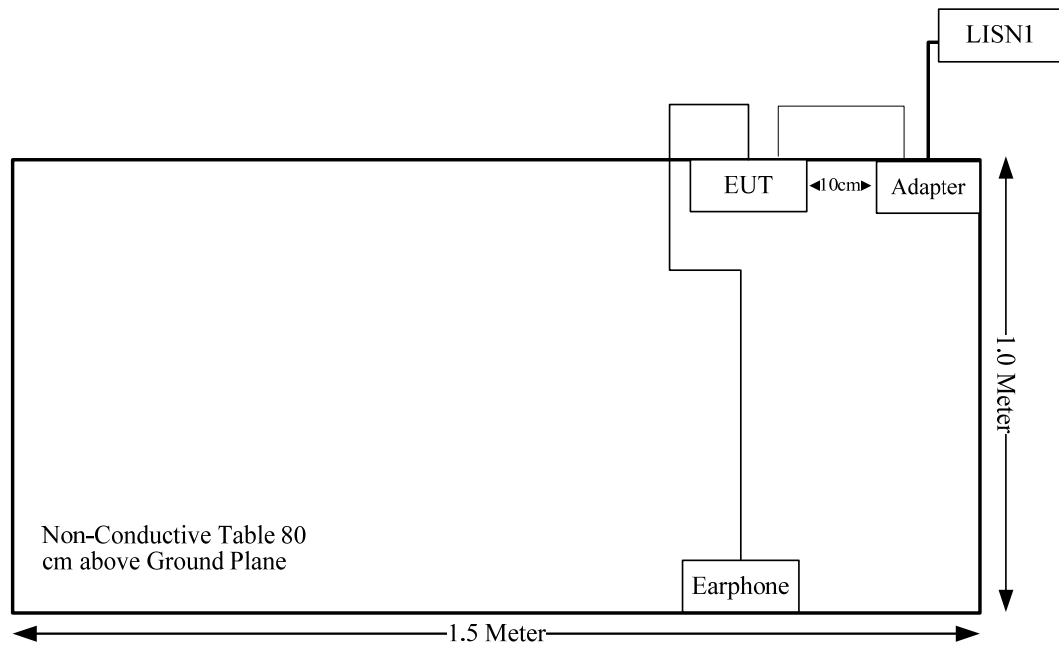
No modification was made to the EUT.

## Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From	To
USB Cable	No	No	1.2	EUT	Adapter
Earphone Cable	No	No	1.2	EUT	Earphone



### Block Diagram of Test Setup



**SUMMARY OF TEST RESULTS**

FCC Rules	Description of Test	Result
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Bandwidth	Compliance
§15.247(b)(3)	Maximum Conducted Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

---

**FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE**

---

**Applicable Standard**

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

**Measurement Result**

The max conducted power including tune-up tolerance is 9.5 dBm (8.9 mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$   
 $= 8.9/5 \cdot (\sqrt{2.462}) = 2.8 < 3.0$

**So the stand-alone SAR evaluation is not necessary.**

---

## **FCC §15.203 - ANTENNA REQUIREMENT**

---

### **Applicable Standard**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

### **Antenna Connector Construction**

The EUT has one internal antenna arrangement for WIFI, and the antenna gain is -3 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

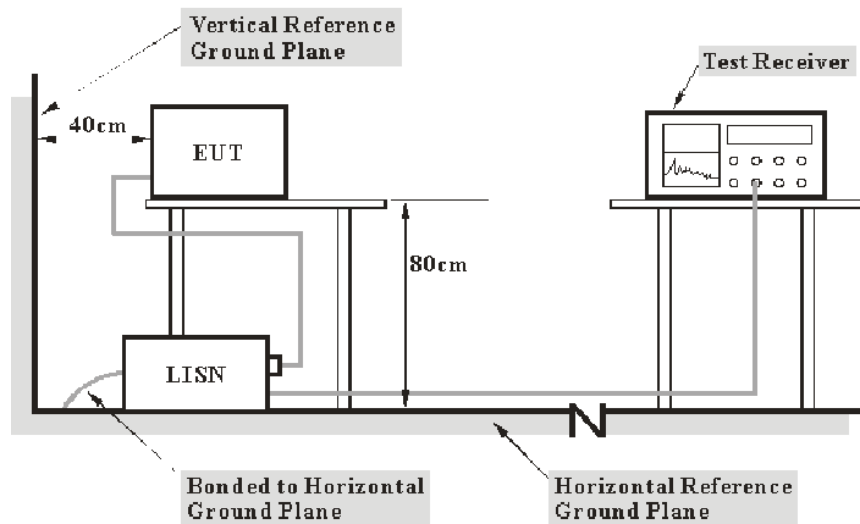
**Result:** Compliance.

## FCC §15.207 (a)– AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC§15.207(a)

### EUT Setup



Note: 1. Support units were connected to second LISN.  
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN with a 120 V/60 Hz AC power source.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

## Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

$V_C$  (cord. Reading): corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

VDF: voltage division factor of AMN

$C_f$ : Correction Factor

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2017-12-11	2018-12-11
R&S	Two-line V-network	ENV 216	101614	2017-12-08	2018-12-08
R&S	L.I.S.N	ESH2-Z5	892107/021	2017-09-25	2018-09-25
N/A	Coaxial Cable	C-NJNJ-50	C-0200-01	2017-09-05	2018-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

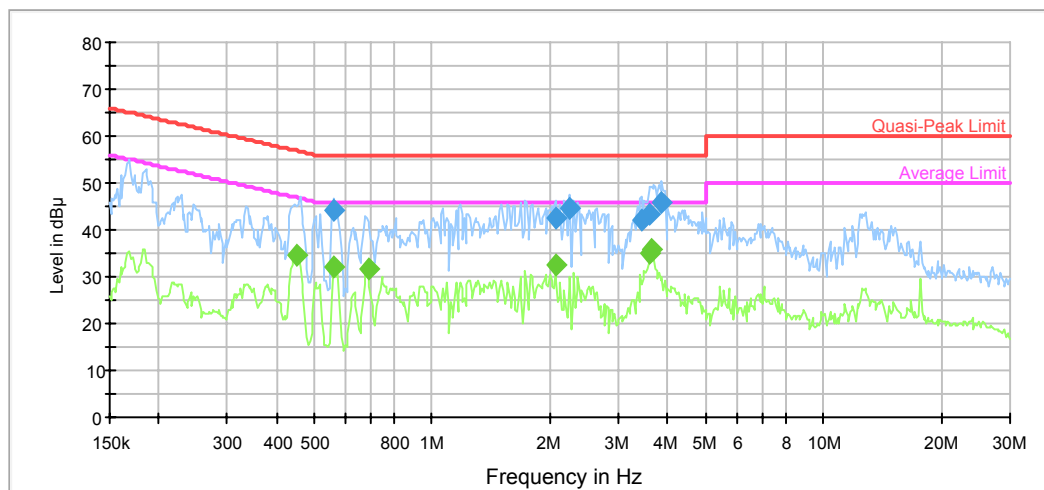
**Test Data****Environmental Conditions**

<b>Temperature:</b>	25.6 °C
<b>Relative Humidity:</b>	47 %
<b>ATM Pressure:</b>	101.1 kPa

The testing was performed by Jim Zhang on 2018-03-30.

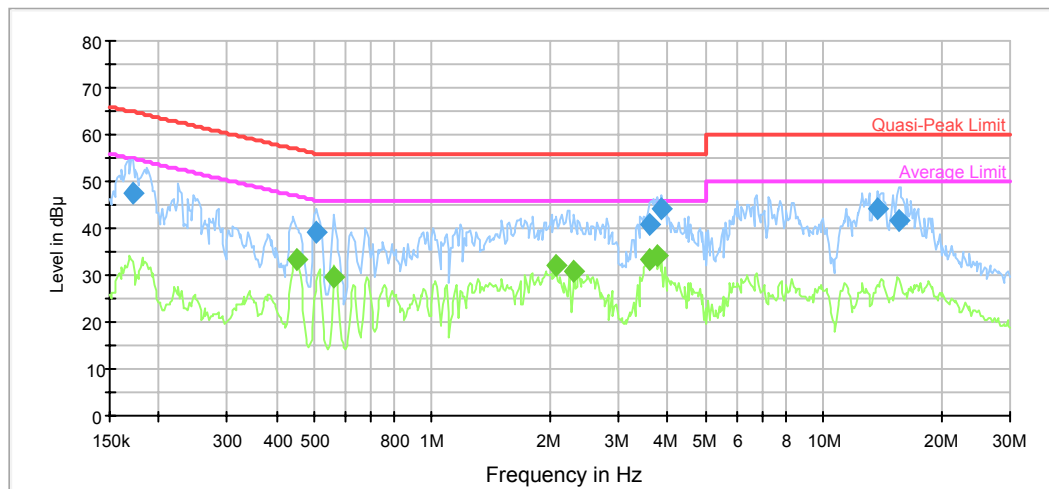
Test Mode: Transmitting

AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.563041	44.0	9.000	L1	9.9	12.0	56.0	Compliance
2.063510	42.5	9.000	L1	9.7	13.5	56.0	Compliance
2.234662	44.4	9.000	L1	9.7	11.6	56.0	Compliance
3.436218	41.9	9.000	L1	9.8	14.1	56.0	Compliance
3.575883	43.3	9.000	L1	9.8	12.7	56.0	Compliance
3.872475	45.6	9.000	L1	9.8	10.4	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.450448	34.6	9.000	L1	9.9	12.3	46.9	Compliance
0.558572	32.0	9.000	L1	9.9	14.0	46.0	Compliance
0.687153	31.8	9.000	L1	9.8	14.2	46.0	Compliance
2.063510	32.6	9.000	L1	9.7	13.4	46.0	Compliance
3.575883	34.9	9.000	L1	9.8	11.1	46.0	Compliance
3.633326	35.7	9.000	L1	9.8	10.3	46.0	Compliance

**AC120 V, 60 Hz, Neutral:**

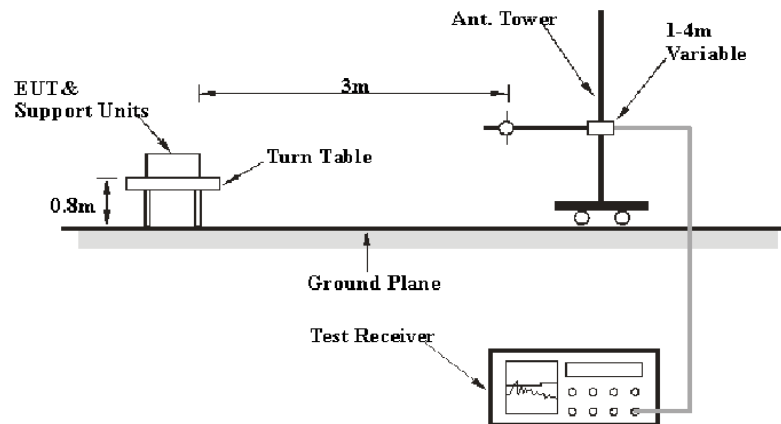
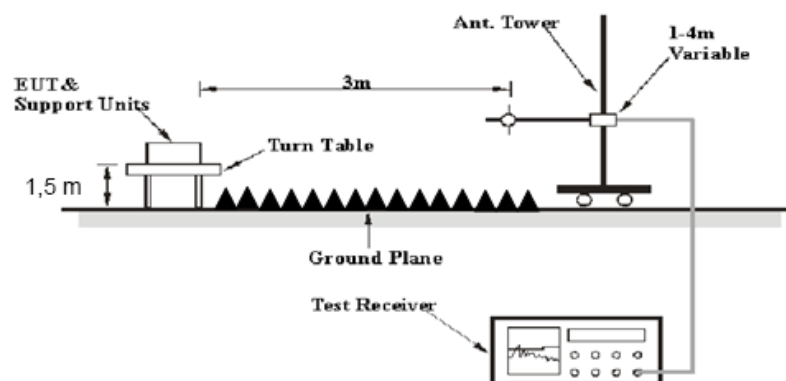
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.171759	47.5	9.000	N	10.9	17.4	64.9	Compliance
0.507637	39.0	9.000	N	9.9	17.0	56.0	Compliance
3.575883	40.7	9.000	N	9.8	15.3	56.0	Compliance
3.872475	44.1	9.000	N	9.8	11.9	56.0	Compliance
13.747168	44.2	9.000	N	9.9	15.8	60.0	Compliance
15.616430	41.6	9.000	N	10.0	18.4	60.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.450448	33.3	9.000	N	9.9	13.6	46.9	Compliance
0.563041	29.6	9.000	N	9.8	16.4	46.0	Compliance
2.063510	32.1	9.000	N	9.8	13.9	46.0	Compliance
2.307034	30.8	9.000	N	9.8	15.2	46.0	Compliance
3.575883	33.5	9.000	N	9.8	12.5	46.0	Compliance
3.750995	34.2	9.000	N	9.8	11.8	46.0	Compliance



**FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS****Applicable Standard**

FCC §15.247 (d); §15.209; §15.205;

**EUT Setup****Below 1GHz:****Above 1GHz:**

The radiated emission Below 1GHz tests were performed in the 3 meters chamber test site A, above 1GHz tests were performed in the 3 meters chamber test site B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The spacing between the peripherals was 10 cm.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

30MHz-1000MHz:

Measurement	RBW	Video B/W	IF B/W
QP	120 kHz	300 kHz	120kHz

1GHz- 25GHz:

Measurement	Duty cycle	RBW	Video B/W
PK	Any	1MHz	3 MHz
AV	>98%	1MHz	10 Hz
	<98%	1MHz	1/T

Note: T is minimum transmission duration

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
R&S	EMI Test Receiver	ESCI	100224	2017-12-11	2018-12-11
HP	Amplifier	8447D	2727A05902	2017-09-05	2018-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2017-12-08	2018-12-08
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-01 1304	2016-11-18	2019-11-18
Quinstar	Amplifier	QLW-18405536-JO	15964001001	2017-06-27	2018-06-27
Chengdu Ouli	Band Rejection Filter	2400-2483.5	002	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0400-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-0075-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-NJNJ-50	C-1000-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
N/A	Coaxial Cable	C-2.4J2.4J-50	C-0700-02	2017-06-27	2018-06-27
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

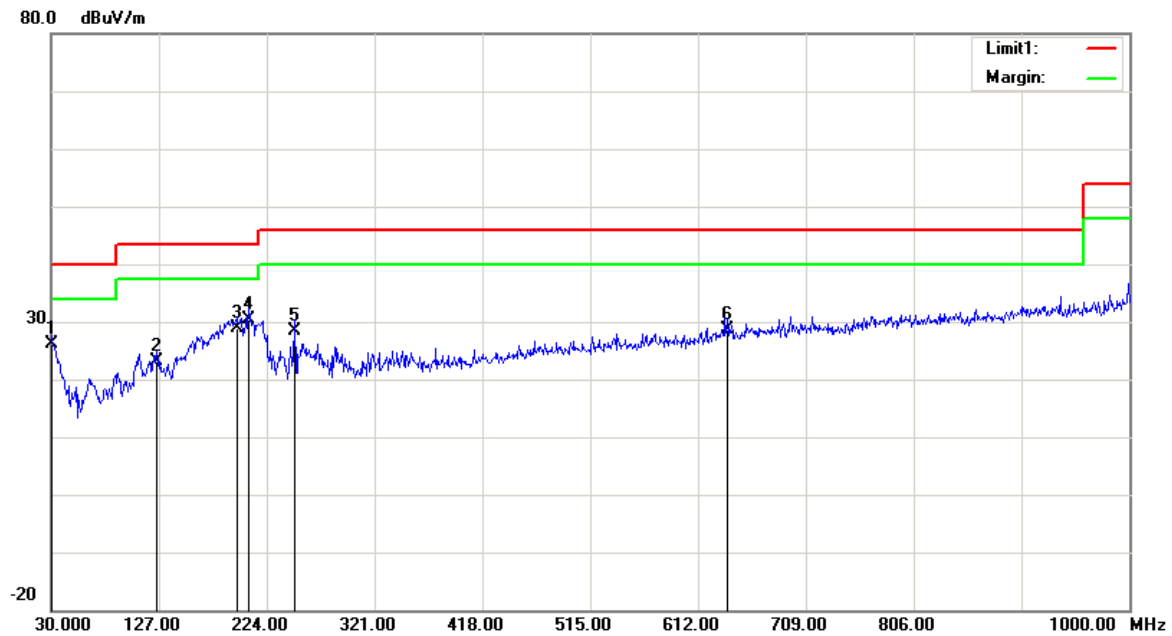
**Test Data****Environmental Conditions**

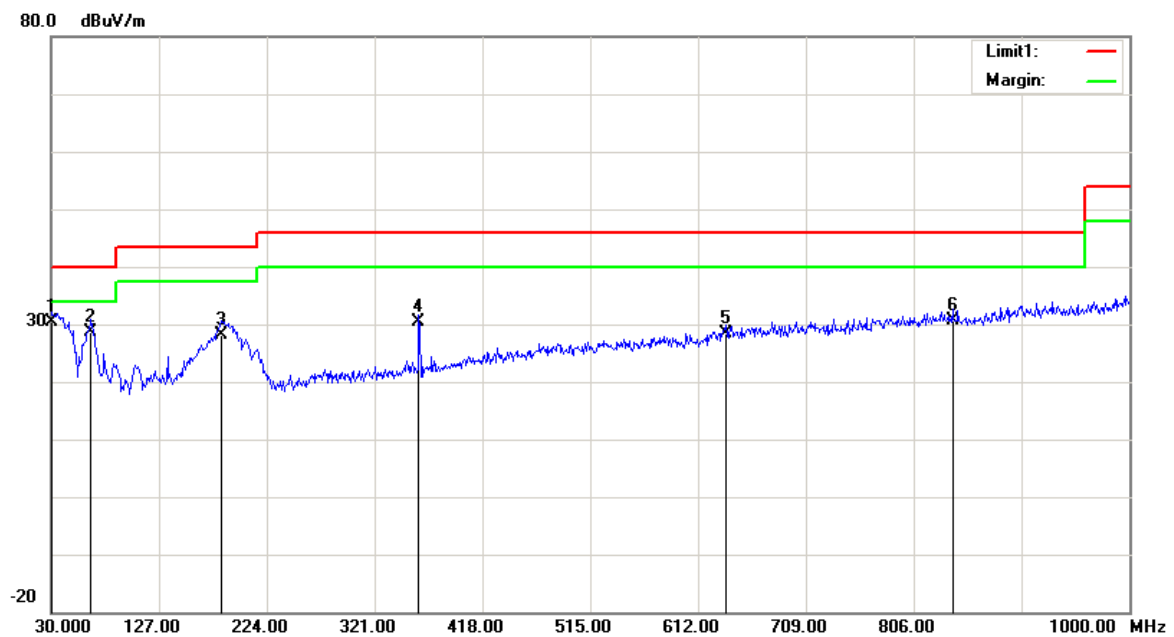
<b>Temperature:</b>	23.8 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101 kPa

\* The testing was performed by Blake Yang&Sunny Cen on 2018-04-02.

*Test Result: Compliance, please Refer to the following data*

*Test Mode: Transmitting*

**1) 30MHz-1GHz (802.11b Mode Low channel was the worst):****Horizontal:**

**Vertical:**

Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.0000	28.86	QP	1.54	30.40	40.00	9.60
65.8900	40.37	QP	-11.77	28.60	40.00	11.40
183.2600	35.71	QP	-7.61	28.10	43.50	15.40
360.7700	33.13	QP	-2.83	30.30	46.00	15.70
637.2200	26.05	QP	2.25	28.30	46.00	17.70
840.9200	25.24	QP	5.46	30.70	46.00	15.30

**2) 1-25GHz:**

802.11b Mode:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	62.71	PK	H	28.12	1.81	0.00	92.64	N/A	N/A
2412.00	58.04	AV	H	28.12	1.81	0.00	87.97	N/A	N/A
2412.00	62.48	PK	V	28.12	1.81	0.00	92.41	N/A	N/A
2412.00	57.92	AV	V	28.12	1.81	0.00	87.85	N/A	N/A
2390.00	23.88	PK	H	28.08	1.80	0.00	53.76	74.00	20.24
2390.00	13.97	AV	H	28.08	1.80	0.00	43.85	54.00	10.15
4824.00	48.55	PK	H	32.95	3.19	37.20	47.49	74.00	26.51
4824.00	43.47	AV	H	32.95	3.19	37.20	42.41	54.00	11.59
7236.00	45.27	PK	H	35.81	4.77	37.27	48.58	74.00	25.42
7236.00	41.44	AV	H	35.81	4.77	37.27	44.75	54.00	9.25
Middle Channel: 2437 MHz									
2437.00	62.14	PK	H	28.17	1.82	0.00	92.13	N/A	N/A
2437.00	57.93	AV	H	28.17	1.82	0.00	87.92	N/A	N/A
2437.00	60.73	PK	V	28.17	1.82	0.00	90.72	N/A	N/A
2437.00	56.48	AV	V	28.17	1.82	0.00	86.47	N/A	N/A
4874.00	47.39	PK	H	33.05	3.26	37.21	46.49	74.00	27.51
4874.00	41.98	AV	H	33.05	3.26	37.21	41.08	54.00	12.92
7311.00	44.79	PK	H	36.01	4.64	37.36	48.08	74.00	25.92
7311.00	39.98	AV	H	36.01	4.64	37.36	43.27	54.00	10.73
High Channel: 2462 MHz									
2462.00	62.64	PK	H	28.22	1.83	0.00	92.69	N/A	N/A
2462.00	58.68	AV	H	28.22	1.83	0.00	88.73	N/A	N/A
2462.00	61.51	PK	V	28.22	1.83	0.00	91.56	N/A	N/A
2462.00	56.91	AV	V	28.22	1.83	0.00	86.96	N/A	N/A
2483.50	24.54	PK	H	28.27	1.84	0.00	54.65	74.00	19.35
2483.50	13.47	AV	H	28.27	1.84	0.00	43.58	54.00	10.42
4924.00	48.59	PK	H	33.15	3.27	37.22	47.79	74.00	26.21
4924.00	41.82	AV	H	33.15	3.27	37.22	41.02	54.00	12.98
7386.00	44.20	PK	H	36.20	4.51	37.46	47.45	74.00	26.55
7386.00	40.05	AV	H	36.20	4.51	37.46	43.30	54.00	10.70

802.11g Mode:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	62.60	PK	H	28.12	1.81	0.00	92.53	N/A	N/A
2412.00	52.51	AV	H	28.12	1.81	0.00	82.44	N/A	N/A
2412.00	61.57	PK	V	28.12	1.81	0.00	91.50	N/A	N/A
2412.00	51.67	AV	V	28.12	1.81	0.00	81.60	N/A	N/A
2390.00	22.93	PK	H	28.08	1.80	0.00	52.81	74.00	21.19
2390.00	12.99	AV	H	28.08	1.80	0.00	42.87	54.00	11.13
4824.00	46.98	PK	H	32.95	3.19	37.20	45.92	74.00	28.08
4824.00	36.06	AV	H	32.95	3.19	37.20	35.00	54.00	19.00
7236.00	45.00	PK	H	35.81	4.77	37.27	48.31	74.00	25.69
7236.00	35.24	AV	H	35.81	4.77	37.27	38.55	54.00	15.45
Middle Channel: 2437 MHz									
2437.00	62.71	PK	H	28.17	1.82	0.00	92.70	N/A	N/A
2437.00	52.50	AV	H	28.17	1.82	0.00	82.49	N/A	N/A
2437.00	61.13	PK	V	28.17	1.82	0.00	91.12	N/A	N/A
2437.00	51.59	AV	V	28.17	1.82	0.00	81.58	N/A	N/A
4874.00	47.73	PK	H	33.05	3.26	37.21	46.83	74.00	27.17
4874.00	37.07	AV	H	33.05	3.26	37.21	36.17	54.00	17.83
7311.00	43.50	PK	H	36.01	4.64	37.36	46.79	74.00	27.21
7311.00	33.49	AV	H	36.01	4.64	37.36	36.78	54.00	17.22
High Channel: 2462 MHz									
2462.00	61.74	PK	H	28.22	1.83	0.00	91.79	N/A	N/A
2462.00	52.91	AV	H	28.22	1.83	0.00	82.96	N/A	N/A
2462.00	61.13	PK	V	28.22	1.83	0.00	91.18	N/A	N/A
2462.00	52.12	AV	V	28.22	1.83	0.00	82.17	N/A	N/A
2483.50	22.81	PK	H	28.27	1.84	0.00	52.92	74.00	21.08
2483.50	13.75	AV	H	28.27	1.84	0.00	43.86	54.00	10.14
4924.00	48.72	PK	H	33.15	3.27	37.22	47.92	74.00	26.08
4924.00	38.68	AV	H	33.15	3.27	37.22	37.88	54.00	16.12
7386.00	44.67	PK	H	36.20	4.51	37.46	47.92	74.00	26.08
7386.00	34.36	AV	H	36.20	4.51	37.46	37.61	54.00	16.39

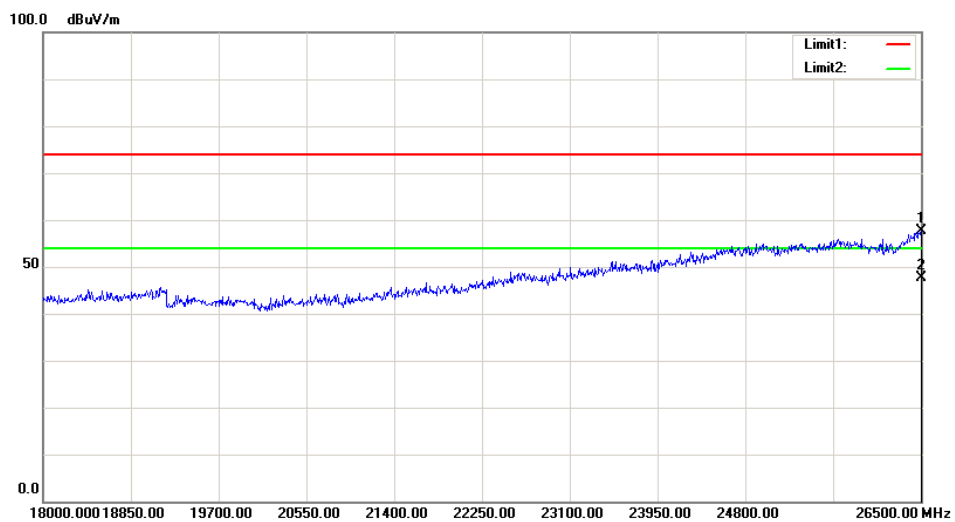
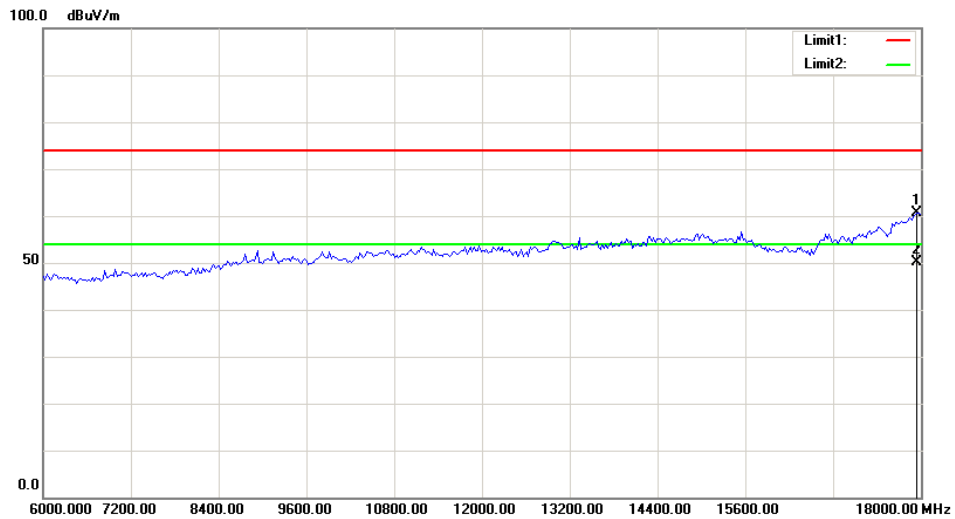
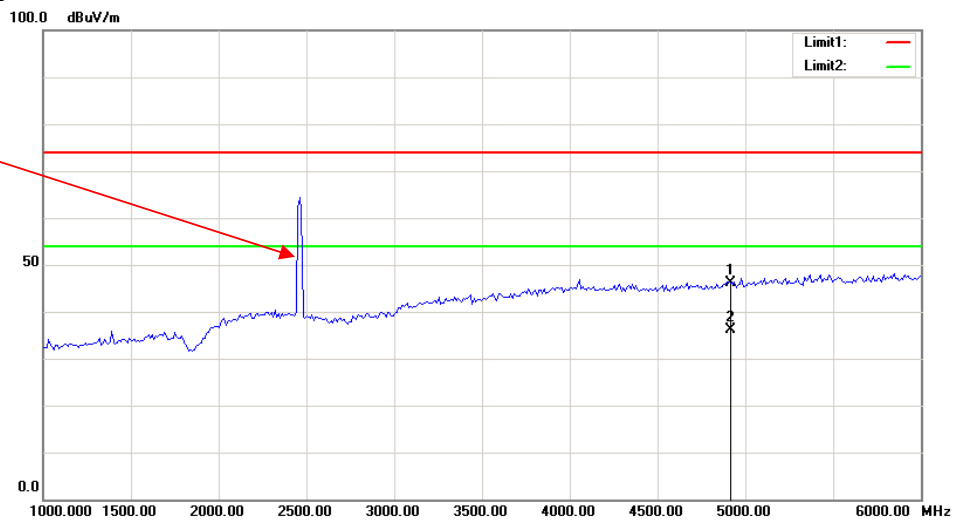
802.11n ht20 Mode:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 2412 MHz									
2412.00	66.95	PK	H	28.12	1.81	0.00	96.88	N/A	N/A
2412.00	55.79	AV	H	28.12	1.81	0.00	85.72	N/A	N/A
2412.00	65.96	PK	V	28.12	1.81	0.00	95.89	N/A	N/A
2412.00	54.83	AV	V	28.12	1.81	0.00	84.76	N/A	N/A
2390.00	33.26	PK	H	28.08	1.80	0.00	63.14	74.00	10.86
2390.00	18.74	AV	H	28.08	1.80	0.00	48.62	54.00	5.38
4824.00	48.62	PK	H	32.95	3.19	37.20	47.56	74.00	26.44
4824.00	37.54	AV	H	32.95	3.19	37.20	36.48	54.00	17.52
7236.00	46.28	PK	H	35.81	4.77	37.27	49.59	74.00	24.41
7236.00	35.44	AV	H	35.81	4.77	37.27	38.75	54.00	15.25
Middle Channel: 2437 MHz									
2437.00	65.71	PK	H	28.17	1.82	0.00	95.70	N/A	N/A
2437.00	55.79	AV	H	28.17	1.82	0.00	85.78	N/A	N/A
2437.00	65.31	PK	V	28.17	1.82	0.00	95.30	N/A	N/A
2437.00	54.02	AV	V	28.17	1.82	0.00	84.01	N/A	N/A
4874.00	48.13	PK	H	33.05	3.26	37.21	47.23	74.00	26.77
4874.00	36.78	AV	H	33.05	3.26	37.21	35.88	54.00	18.12
7311.00	46.21	PK	H	36.01	4.64	37.36	49.50	74.00	24.50
7311.00	34.31	AV	H	36.01	4.64	37.36	37.60	54.00	16.40
High Channel: 2462 MHz									
2462.00	68.14	PK	H	28.22	1.83	0.00	98.19	N/A	N/A
2462.00	57.21	AV	H	28.22	1.83	0.00	87.26	N/A	N/A
2462.00	66.72	PK	V	28.22	1.83	0.00	96.77	N/A	N/A
2462.00	55.65	AV	V	28.22	1.83	0.00	85.70	N/A	N/A
2483.50	35.41	PK	H	28.27	1.84	0.00	65.52	74.00	8.48
2483.50	20.37	AV	H	28.27	1.84	0.00	50.48	54.00	3.52
4924.00	46.90	PK	H	33.15	3.27	37.22	46.10	74.00	27.90
4924.00	37.62	AV	H	33.15	3.27	37.22	36.82	54.00	17.18
7386.00	45.64	PK	H	36.20	4.51	37.46	48.89	74.00	25.11
7386.00	35.07	AV	H	36.20	4.51	37.46	38.32	54.00	15.68



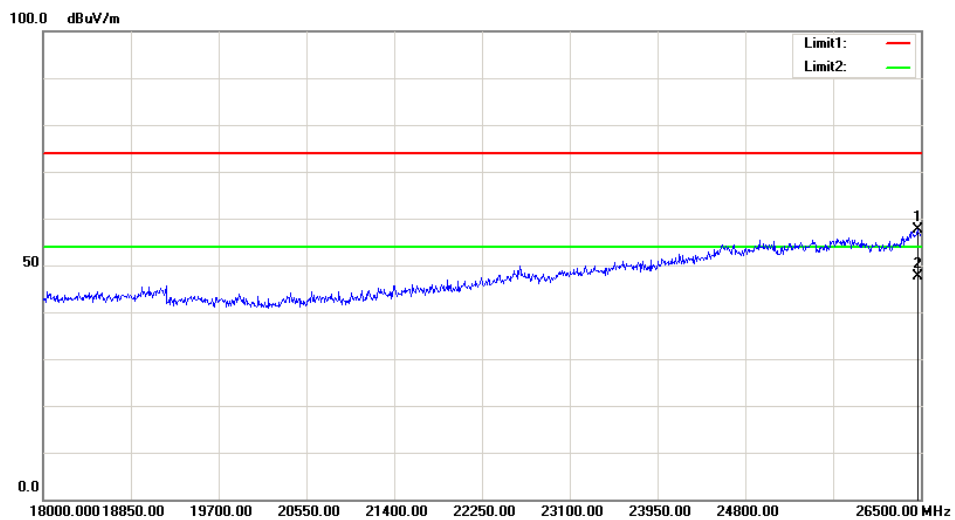
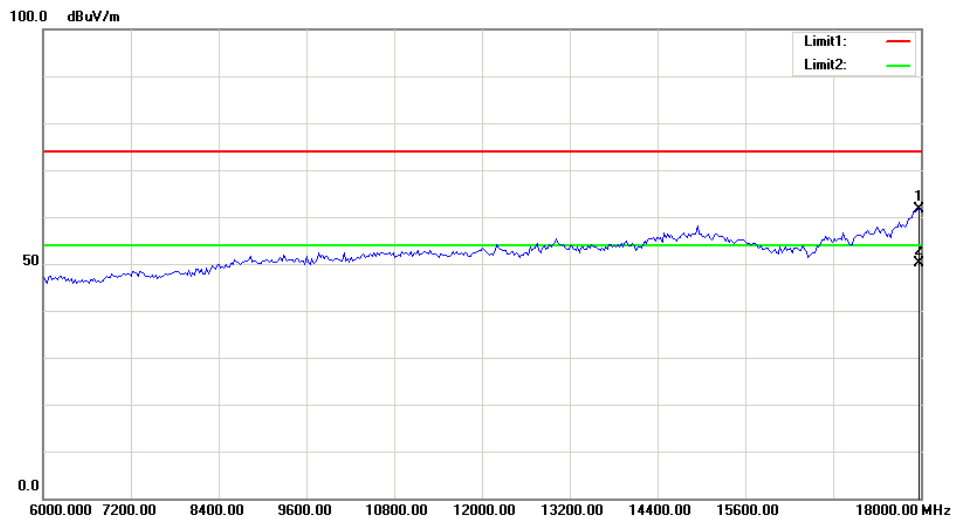
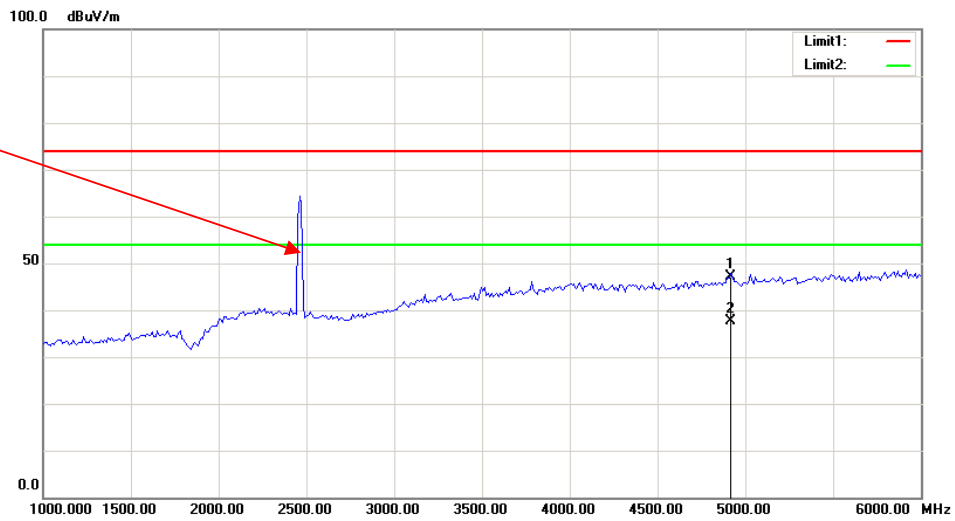
# **Worst plots(802.11b Mode low channel)** **Horizontal**

Fundamental  
Test with Band  
Rejection Filter



**Vertical**

Fundamental  
Test with Band  
Rejection Filter



## FCC §15.247(a) (2)–6 dB EMISSION BANDWIDTH

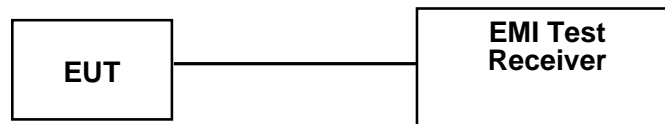
### Applicable Standard

According to FCC §15.247(a) (2)

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### Test Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times \text{RBW}$ .
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	23.1 °C
Relative Humidity:	41 %
ATM Pressure:	102 kPa

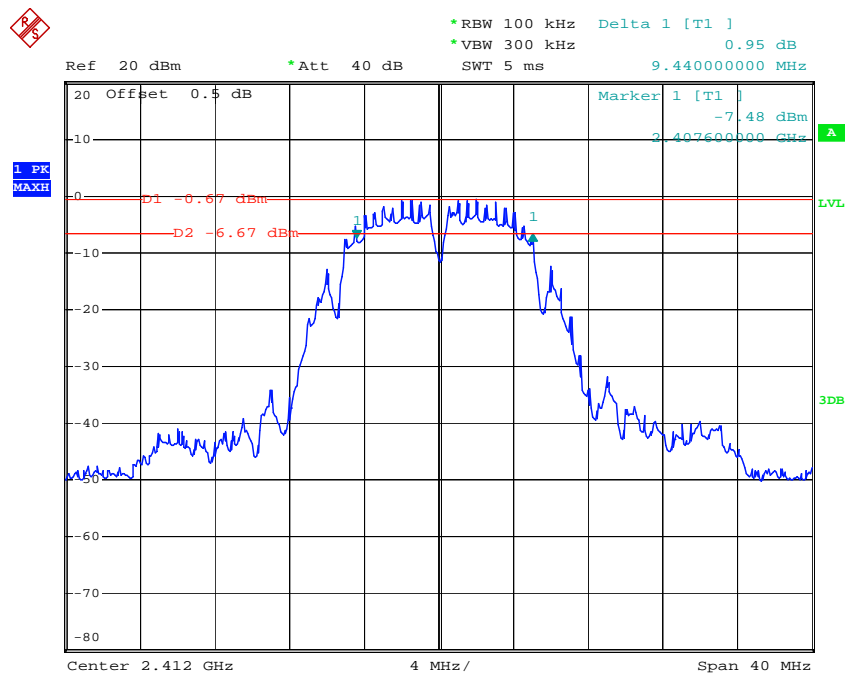
\* The testing was performed by Kami Zhou on 2018-03-31

Test Mode: Transmitting

Test Result: Compliant. Please refer to the following table and plots.

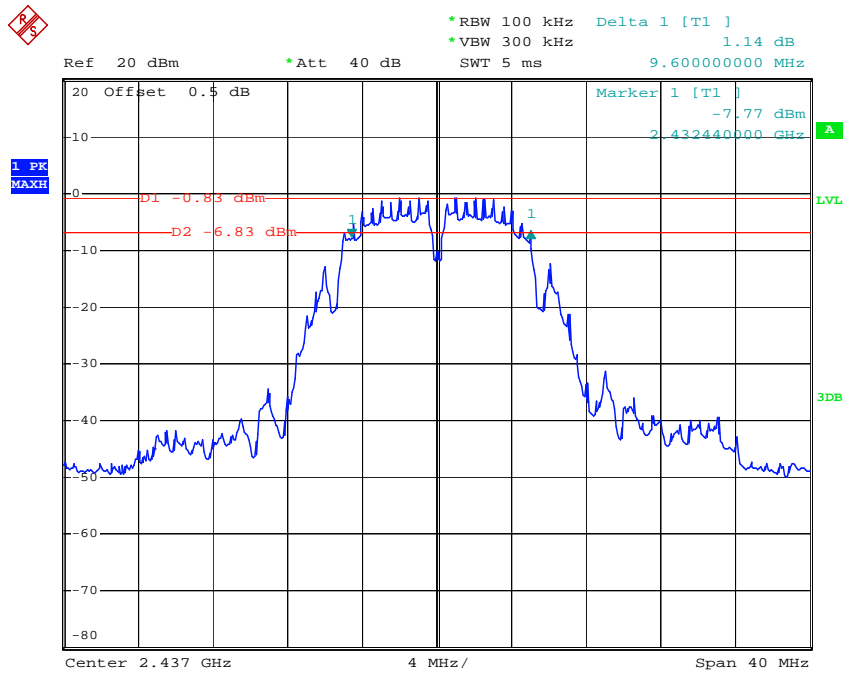
Test mode	Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limit (MHz)
802.11b	Low	2412	9.44	$\geq 0.5$
	Middle	2437	9.60	$\geq 0.5$
	High	2462	10.00	$\geq 0.5$
802.11g	Low	2412	16.00	$\geq 0.5$
	Middle	2437	16.32	$\geq 0.5$
	High	2462	15.92	$\geq 0.5$
802.11n ht20	Low	2412	17.36	$\geq 0.5$
	Middle	2437	17.60	$\geq 0.5$
	High	2462	17.44	$\geq 0.5$

### 802.11b Low Channel



Date: 31.MAR.2018 18:00:23

### 802.11b Middle Channel



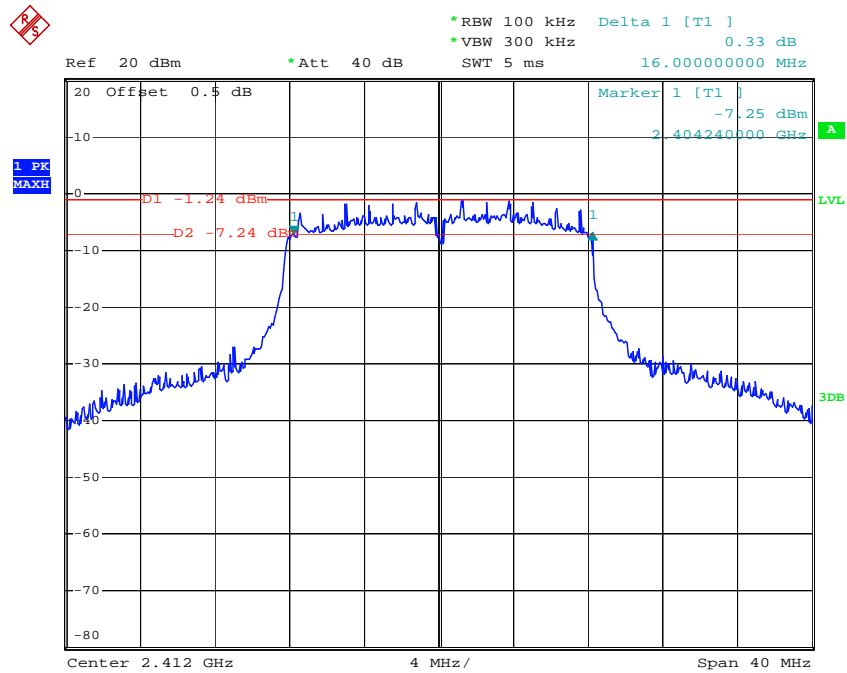
Date: 31.MAR.2018 17:58:45

### 802.11b High Channel



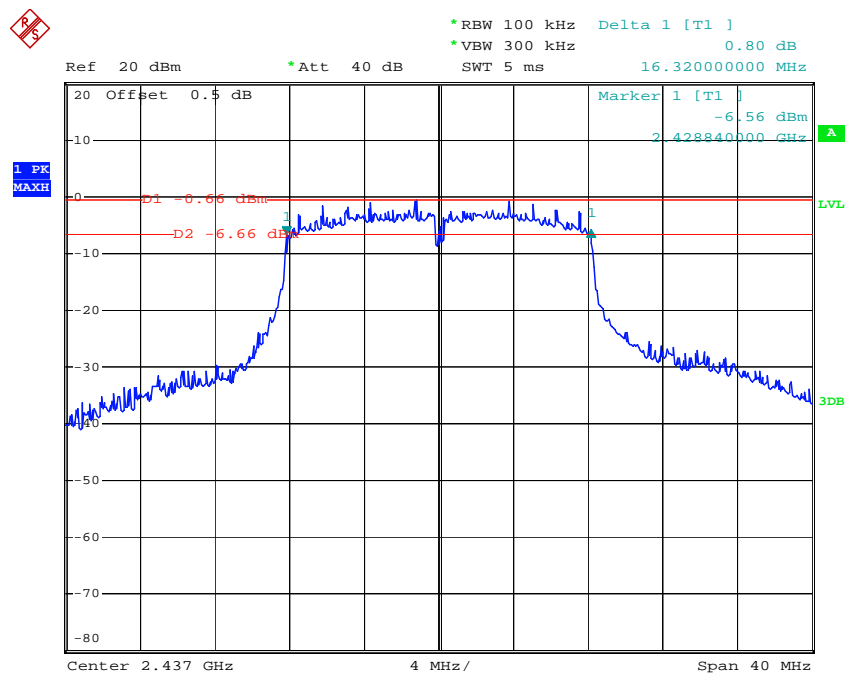
Date: 31.MAR.2018 18:03:11

### 802.11g Low Channel



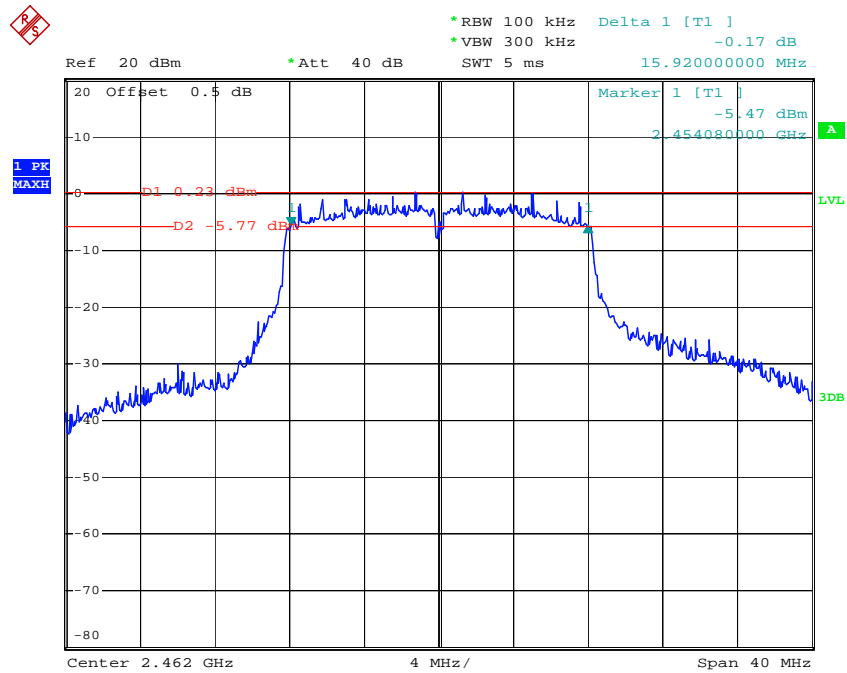
Date: 31.MAR.2018 18:13:10

### 802.11g Middle Channel



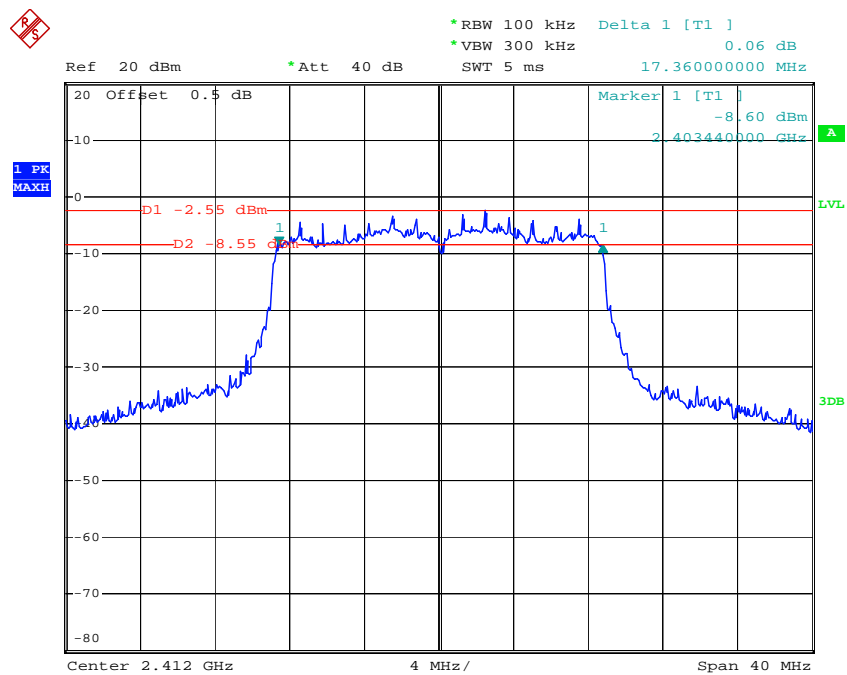
Date: 31.MAR.2018 18:10:29

### 802.11g High Channel



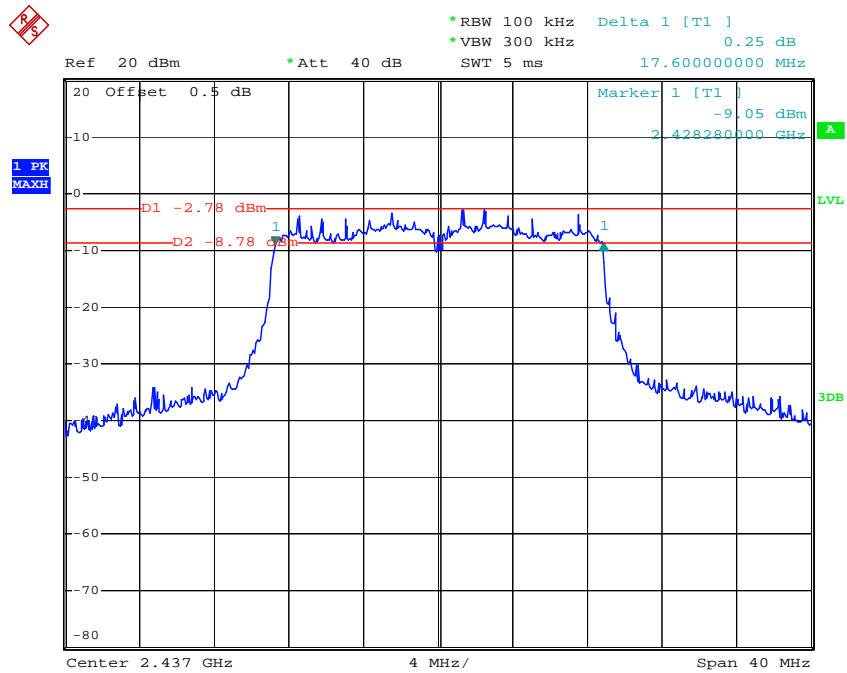
Date: 31.MAR.2018 18:05:28

### 802.11n ht20 Low Channel



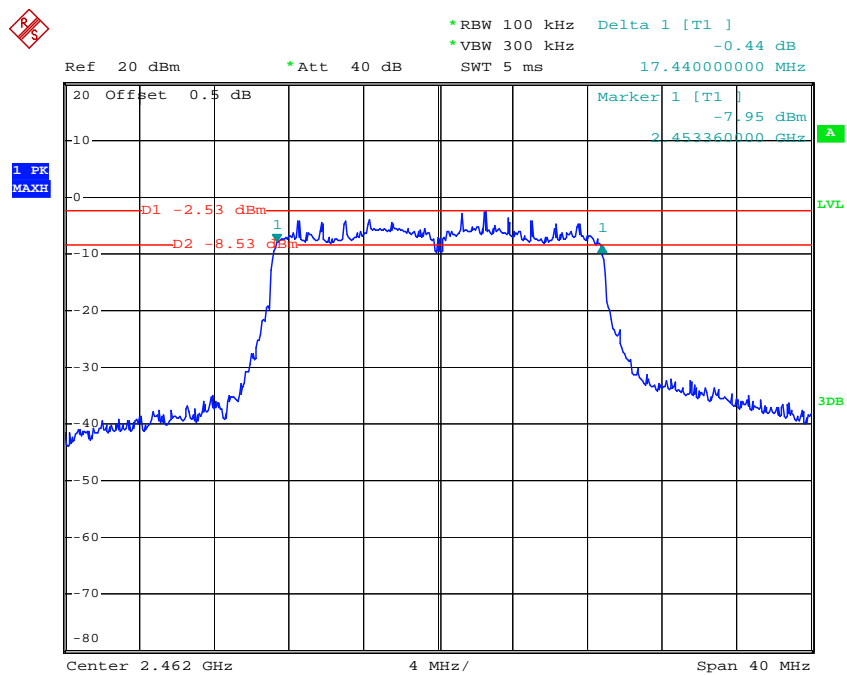
Date: 31.MAR.2018 18:16:39

### 802.11n ht20 Middle Channel



Date: 31.MAR.2018 18:18:45

### 802.11n ht20 High Channel



Date: 31.MAR.2018 18:20:35

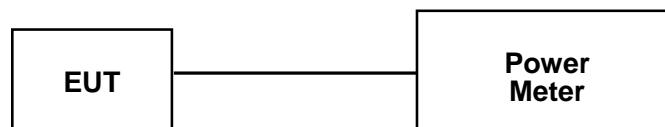


**FCC §15.247(b) (3) - MAXIMUM PEAK CONDUCTED OUTPUT POWER****Applicable Standard**

According to FCC §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

**Test Procedure**

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to test equipment.
3. Add a correction factor to the display.
4. Set the power Meter to test Peak output power, record the result as peak power.
5. Set the power meter to test average output power, record the result as average power.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Wideband Power Sensor	N1921A	MY54210016	2017-11-03	2018-11-03
Agilent	P-Series Power Meter	N1912A	MY5000448	2017-11-03	2018-11-03
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data****Environmental Conditions**

<b>Temperature:</b>	23.1 °C
<b>Relative Humidity:</b>	41 %
<b>ATM Pressure:</b>	102 kPa

*\* The testing was performed by Kami Zhou on 2018-03-31.*

*Test Mode: Transmitting*

*Test Result: Compliant. Please refer to the following table.*

<b>Test mode</b>	<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Max Peak Conducted Output Power (dBm)</b>	<b>Max Conducted Average Output Power (dBm)</b>	<b>Limit (dBm)</b>
802.11b	Low	2412	11.03	7.64	30
	Middle	2437	10.99	7.47	30
	High	2462	11.17	7.62	30
802.11g	Low	2412	16.33	9.09	30
	Middle	2437	17.27	9.27	30
	High	2462	17.66	9.29	30
802.11n ht20	Low	2412	12.28	7.34	30
	Middle	2437	12.56	7.41	30
	High	2462	12.78	7.55	30

**FCC §15.247(d)– 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE****Applicable Standard**

According to FCC§15.247(d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Environmental Conditions

<b>Temperature:</b>	23.1 °C
<b>Relative Humidity:</b>	41 %
<b>ATM Pressure:</b>	102 kPa

*Test Result: Compliant. Please refer to following plots.*

Ref 20 dBm \*Att 40 dB SWT 5 ms 2.398080000 GHz

20 Offset 0.5 dB

Marker 1 [T1] -0.71 dBm 2.414112000 GHz

Marker 2 [T1] -41.65 dBm 2.398080000 GHz

1 PK MAXH

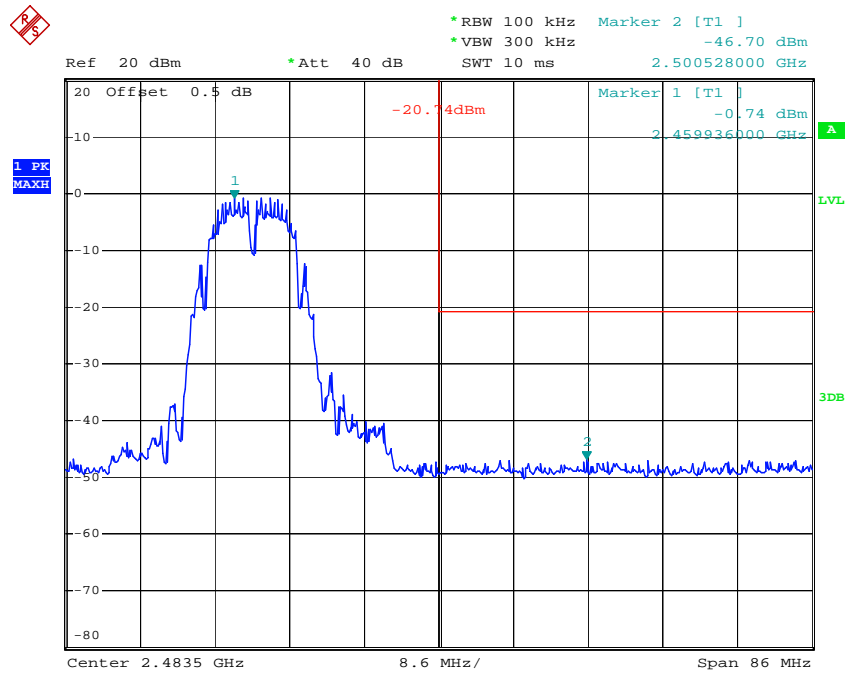
2.414112000 GHz

2.398080000 GHz

Center 2.4 GHz 4.8 MHz/ Span 48 MHz

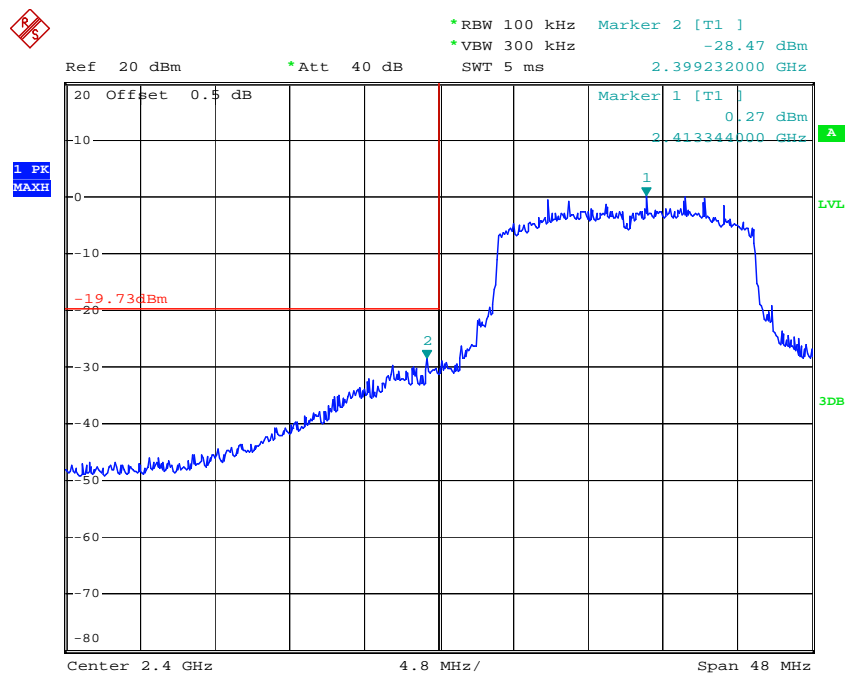
Date: 31.MAR.2018 18:43:38

### 802.11b: Band Edge, Right Side



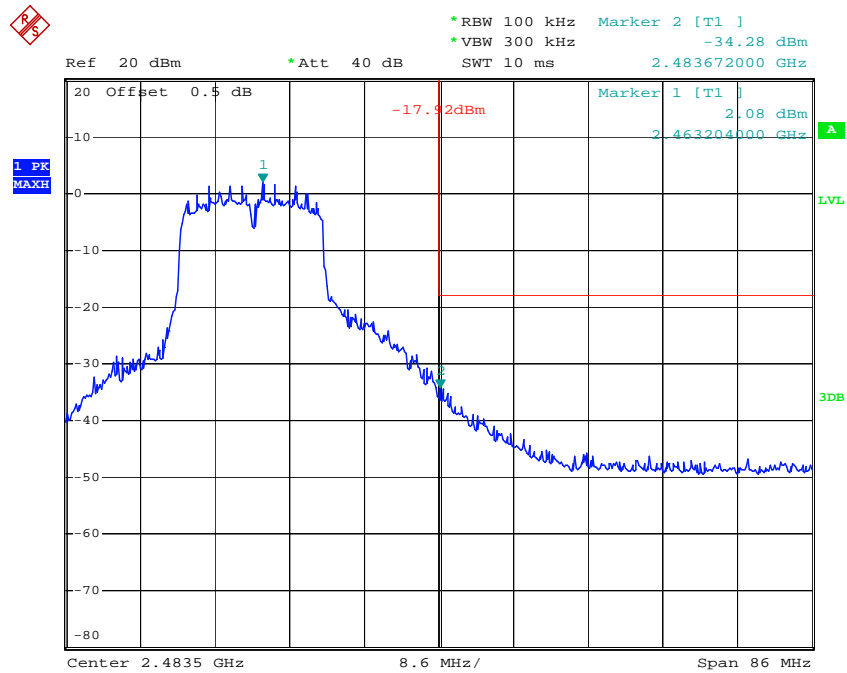
Date: 31.MAR.2018 18:45:11

### 802.11g: Band Edge, Left Side



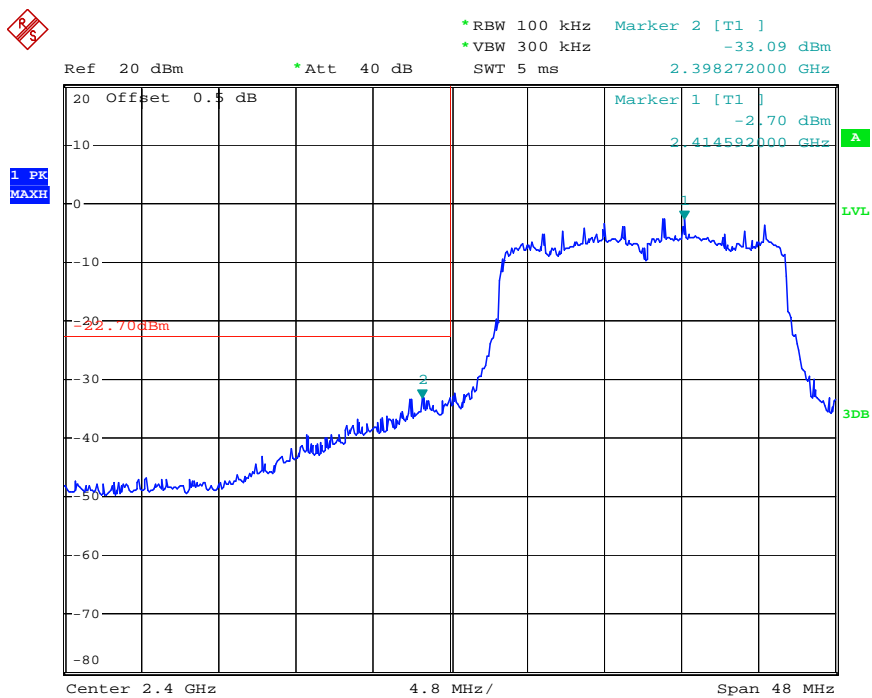
Date: 31.MAR.2018 18:32:36

### 802.11g: Band Edge, Right Side



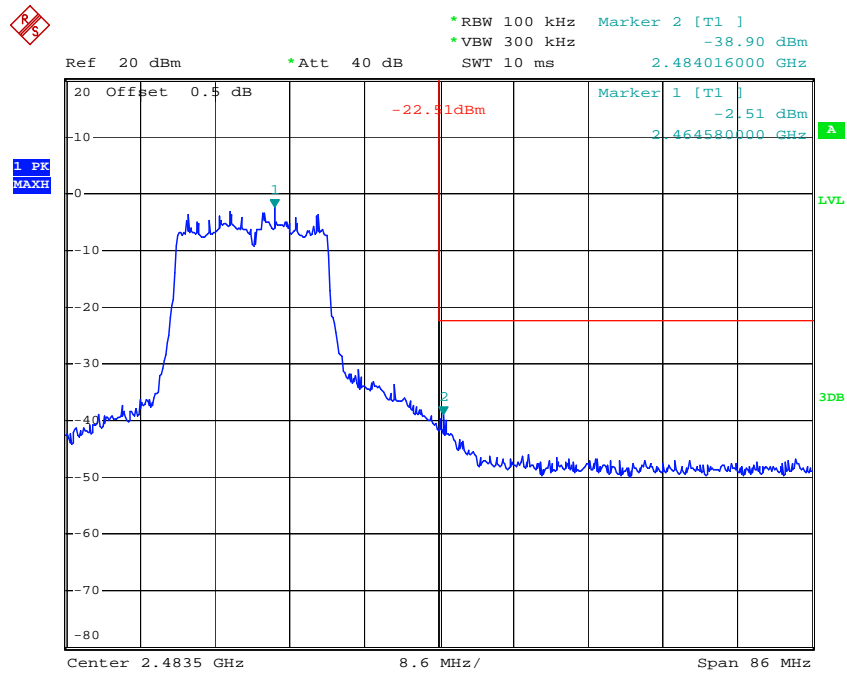
Date: 31.MAR.2018 18:36:39

### 802.11n ht20 Band Edge, Left Side



Date: 31.MAR.2018 18:30:14

### 802.11n ht20 Band Edge, Right Side



Date: 31.MAR.2018 18:23:54

**FCC §15.247(e) - POWER SPECTRAL DENSITY****Applicable Standard**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

**Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the RBW = 3 kHz, VBW = 10 kHz, Set the span to 1.5 times the DTS bandwidth.
4. Use the peak marker function to determine the maximum amplitude level.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESPI	100120	2017-12-11	2018-12-11
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each Time	/

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

**Test Data****Environmental Conditions**

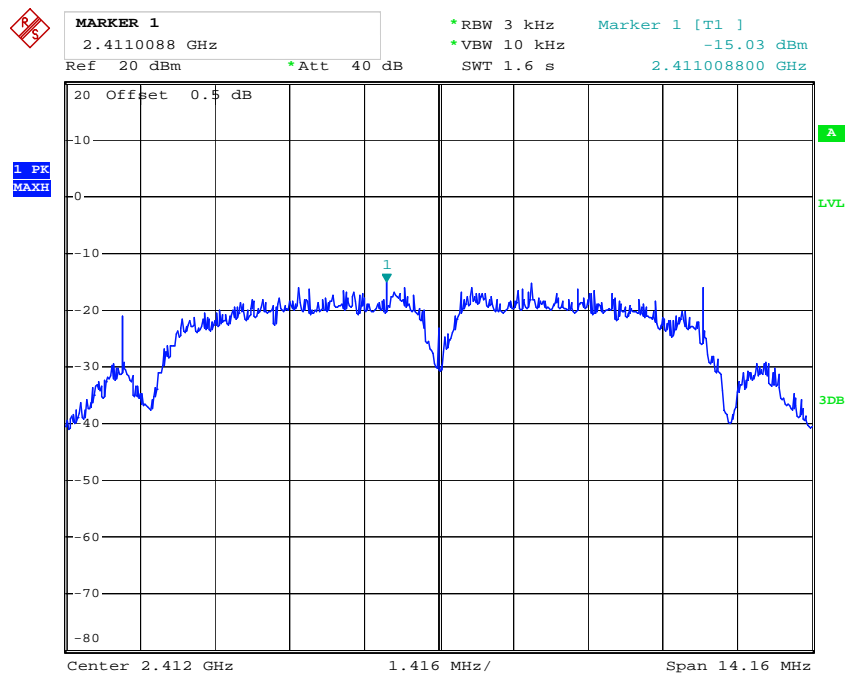
Temperature:	23.1 °C
Relative Humidity:	41 %
ATM Pressure:	102 kPa

\* The testing was performed by Kami Zhou on 2018-03-31.



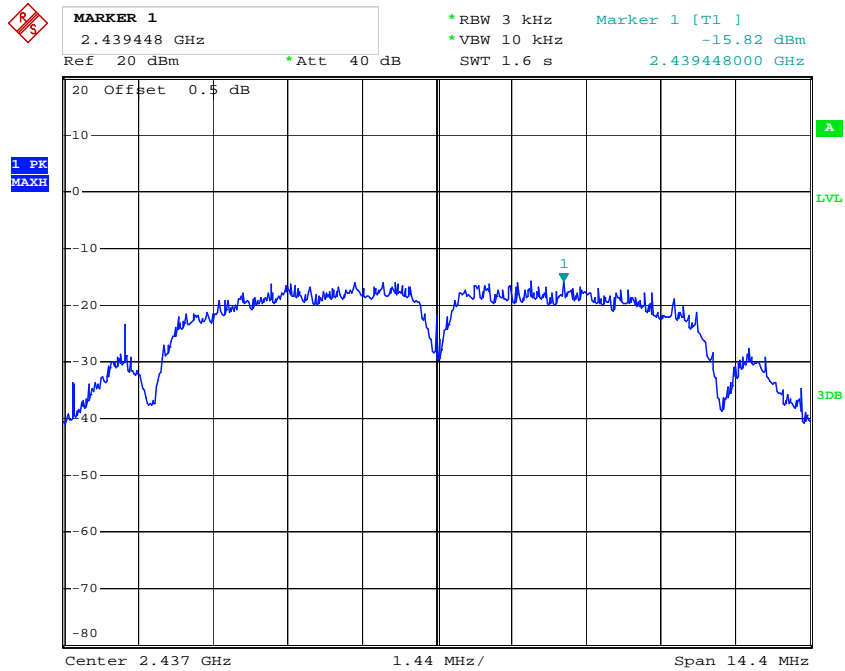
**Test Result: Compliance***Test Mode: Transmitting**Test Result: Compliant. Please refer to the following table and plots*

Test mode	Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	Low	2412	-15.03	≤8
	Middle	2437	-15.82	≤8
	High	2462	-15.93	≤8
802.11g	Low	2412	-10.58	≤8
	Middle	2437	-10.48	≤8
	High	2462	-9.62	≤8
802.11n ht20	Low	2412	-12.06	≤8
	Middle	2437	-12.60	≤8
	High	2462	-11.57	≤8

**Power Spectral Density, 802.11b Low Channel**

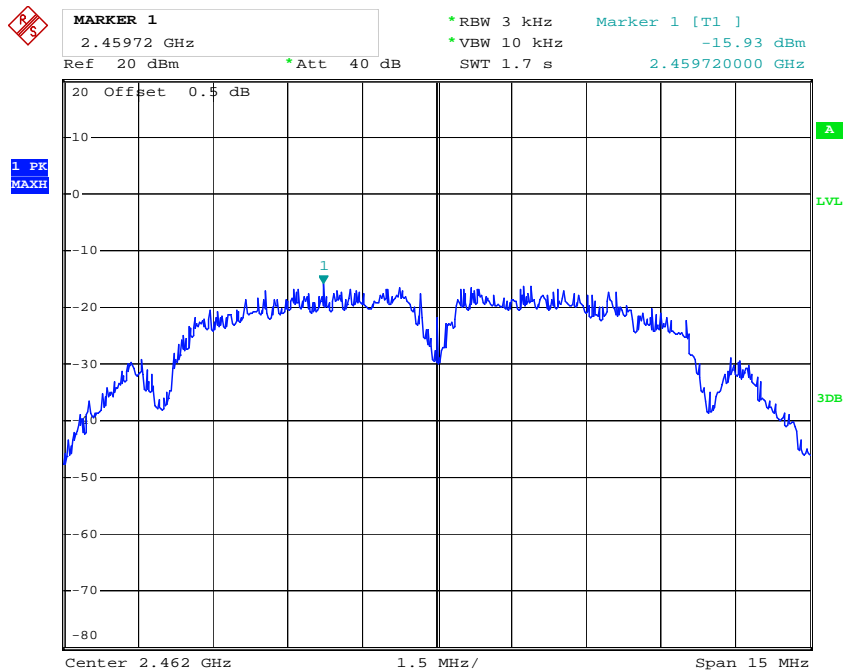
Date: 31.MAR.2018 18:54:33

### Power Spectral Density, 802.11b Middle Channel



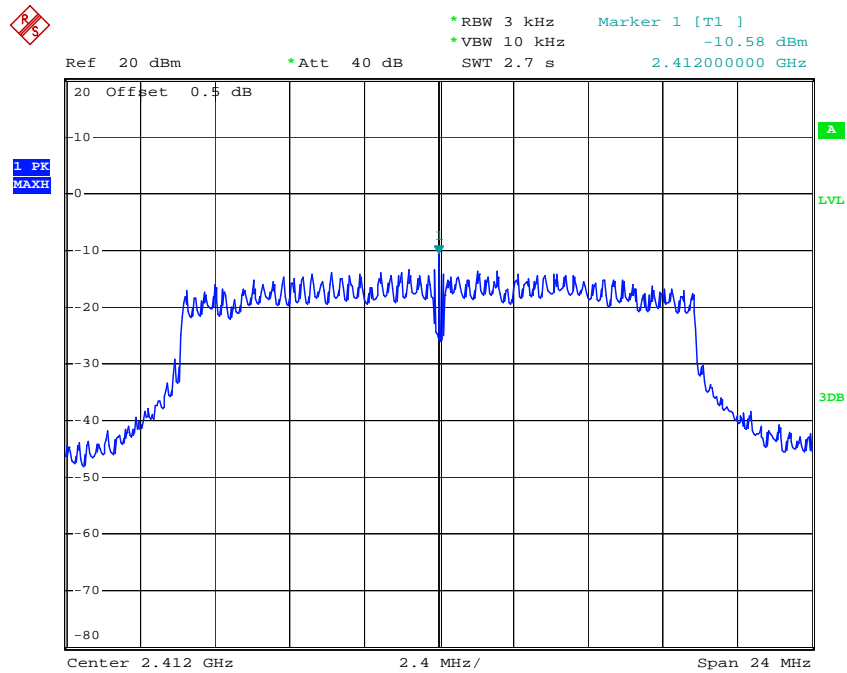
Date: 31.MAR.2018 18:51:28

### Power Spectral Density, 802.11b High Channel



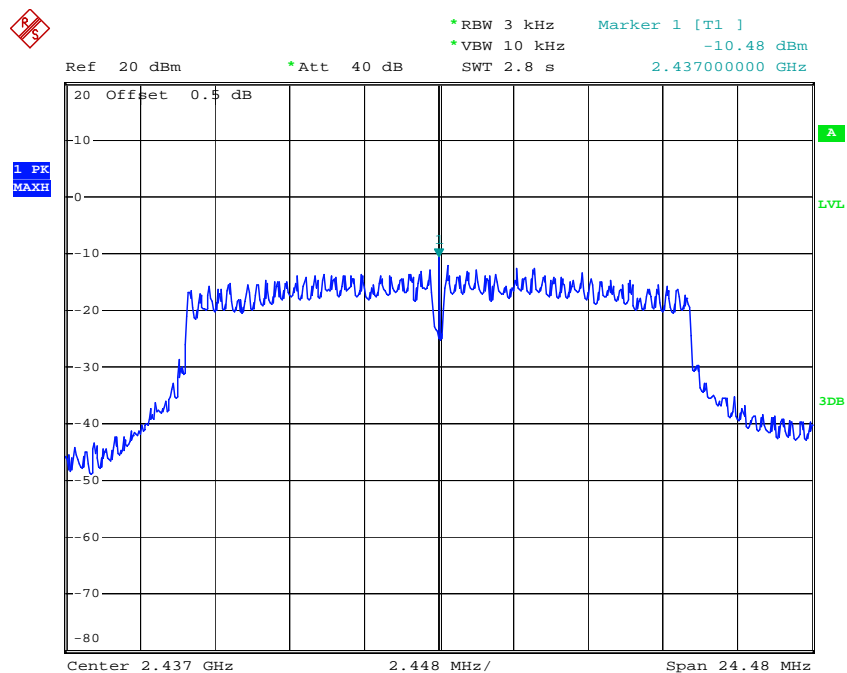
Date: 31.MAR.2018 19:00:07

### Power Spectral Density, 802.11g Low Channel



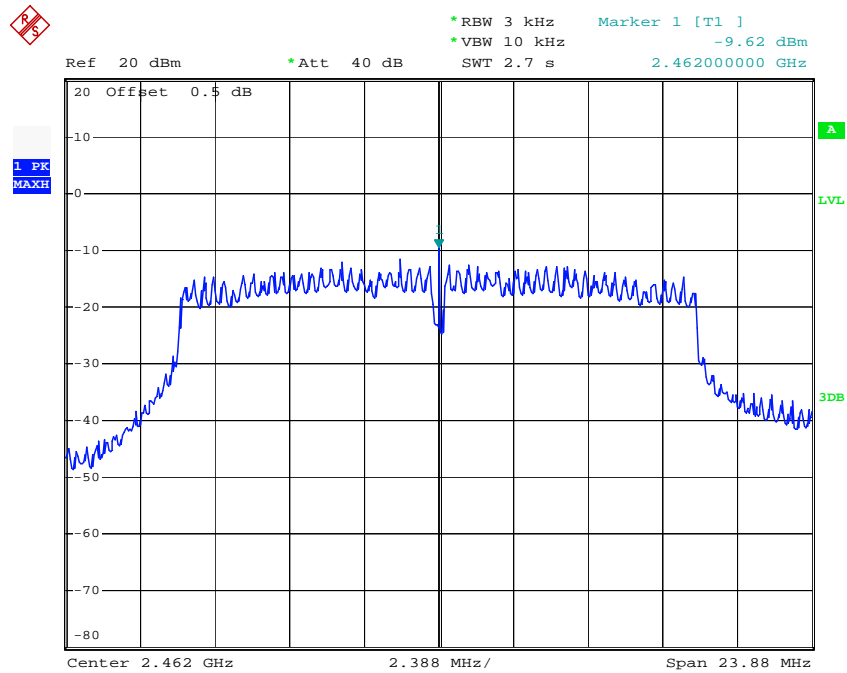
Date: 31.MAR.2018 18:32:10

### Power Spectral Density, 802.11g Middle Channel



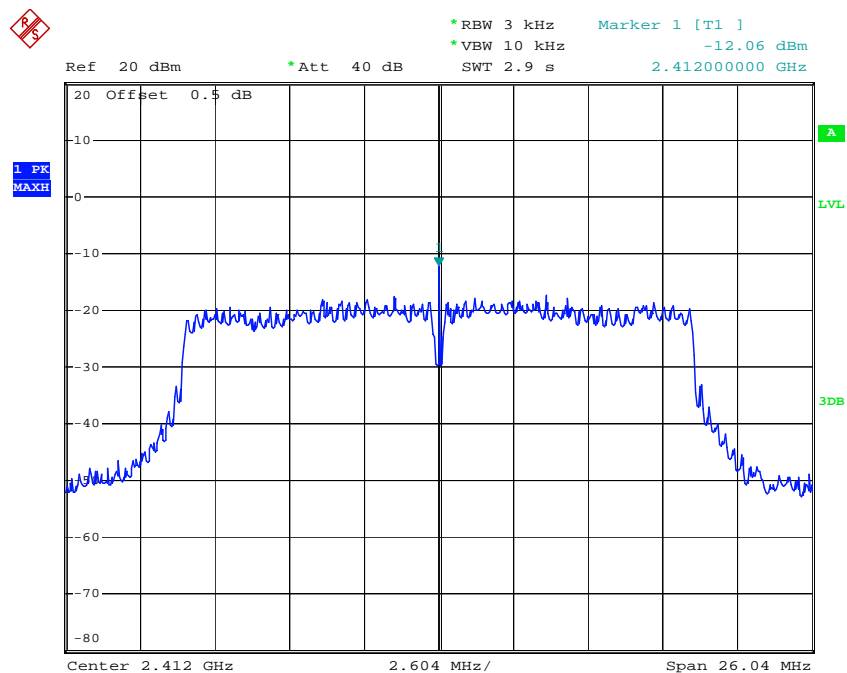
Date: 31.MAR.2018 18:34:17

### Power Spectral Density, 802.11g High Channel



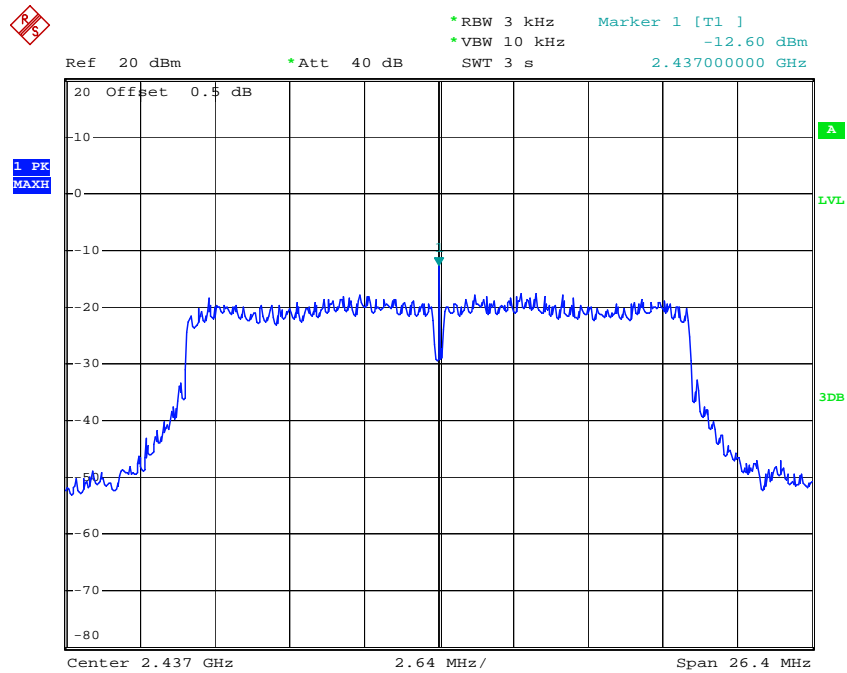
Date: 31.MAR.2018 18:36:03

### Power Spectral Density, 802.11n ht20 Low Channel



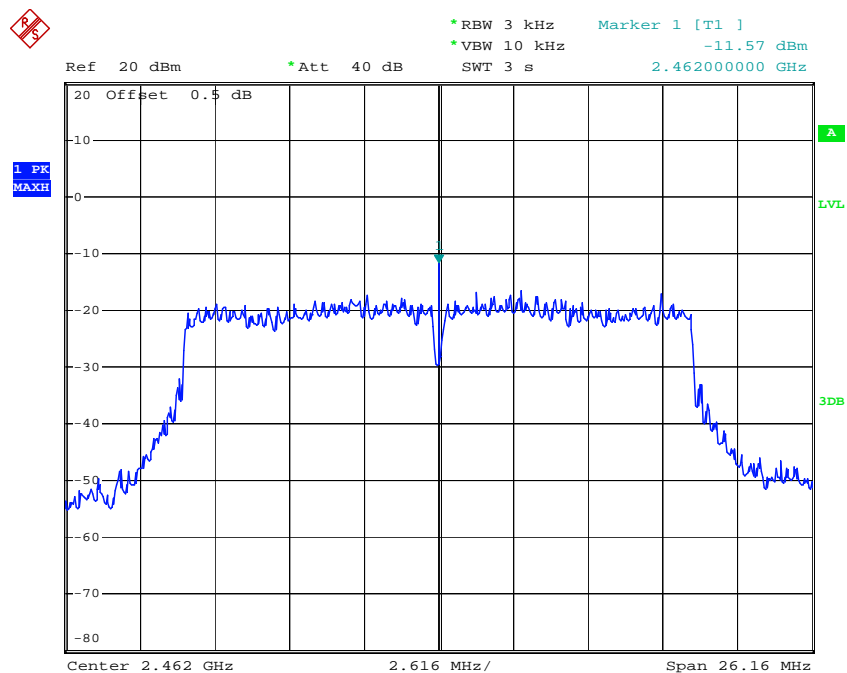
Date: 31.MAR.2018 18:29:45

### Power Spectral Density, 802.11n ht20 Middle Channel



Date: 31.MAR.2018 18:25:46

### Power Spectral Density, 802.11n ht20 High Channel



Date: 31.MAR.2018 18:23:25

\*\*\*\*\* END OF REPORT \*\*\*\*\*